

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF UNUSUAL SOUND SOURCES

EXPERIMENTAL MUSICAL INSTRUMENTS

WHY THE SEA IS BOILING HOT

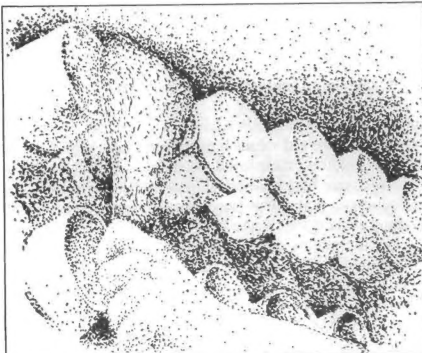
In this issue of **Experimental Musical Instruments** we have a collection of beautiful sound sculpture photographs from the **Artspirit Sings** exhibit currently touring Minnesota. We have as well the promised article on New Zealand's extraordinary **From Scratch** ensemble, creators of symphonic works for instruments dominated by giant aerophonic percussion tubes. We have a report on an exotic approach to guitar fret-spacing; plus some literature and recordings reviews.

AND, starting on this page, we have a narrative on interspecies music: Author Jim Nollman here describes his experiences in interaction with animals based in patterns of rhythm and intonation. Let us turn to that now.

IN THIS ISSUE

Playing Music With Animals	1
Letters	2
The From Scratch percussion ensemble	10
The Artspirit Sings exhibit	14
The Matzaar and Aliquit Tone Scales	18
Cassette Reviews	19
Books:	
Ancient Greek Instruments, and an early acoustics text	22
Notices	23
Recent Articles in Other Periodicals	24

Below: Percussion Pipes, part of the Percussion Stations created by the New Zealand group **From Scratch**. See the article starting on page 6.



Drawing from a photo by Gillian Bailey

PLAYING MUSIC WITH ANIMALS:

Four Passages from *Dolphin Dreamtime*

by Jim Nollman

Excerpted from **Dolphin Dreamtime: The Art and Science of Interspecies Communication** by Jim Nollman, Copyright © 1987 by Jim Nollman. Reprinted by permission of Bantam Books. **Dolphin Dreamtime** is published in paperback by Bantam at \$8.95, and is available at bookstores everywhere.

Jim Nollman works in the field of musical interaction with animals. His organization is Interspecies Communication, Inc., a nonprofit group devoted to balanced interaction with other species, and, more generally, "an integration of the arts and sciences, with a strong emphasis placed upon environmental preservation."

Jim has worked musically with many different land and sea animals. Most of his current work is with whales and dolphins. He has used several musical instruments:

Dolphin sticks are the aquatic equivalent of Latin clavés. They consist of two sticks, made from a Mexican ironwood, that are struck together underwater. They often demand a string tying them to each other as well as to their

(continued on page 6)

THANKS FOR THE COMPARATIVE TUNINGS ARTICLE in the August issue. Excellent overview and a very clear and informative chart.

A couple of notes on Ed Standers' notes [on musical glasses, also in the August issue, EMI Vol. VI #2]:

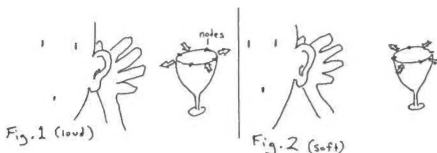
There is an important aspect of glass vibration which should be mentioned, and that is the fact that the vibration pattern of a glass **revolves** with the finger. This can be shown by playing a very thin-walled glass with some water in it. A four-sided standing wave pattern can be clearly seen rotating on the surface of the water.

Concerning the tremolo effect: the rotating standing wave strongly suggests an amplitude vibrato is at work here -- not a variation in pitch.

Why?

Consider what happens when a glass is played.

Let's assume the glass does vibrate, as suggested, in four sections.



In Fig. 1, the quadrant section of glass facing the listener is in a state of maximum vibration so maximum sound energy is directed toward the listener. In Fig. 2, the pattern has rotated 45 degrees so an area of least vibration (node) is directly facing the listener. Not only that, but the two quadrants adjacent to the node are vibrating **out of phase** with each other, so from the listener's standpoint these vibrations cancel each other out. (This is known, ironically enough, as phase cancellation). Another 45 degrees of rotation once more brings an area of maximum vibration to face the listener.

Continuing, we arrive at the conclusion that there will be four tremolos for every revolution of the finger, and that this rate is independent of the size or pitch of the glass. This is indeed the case. Try it!

Michael Meadows
S.O.R.T.
(Scrub Nurse of Science)

which to speak it. The capability of the human mind to connect an emotion to a specific sonic occurrence in real time is beyond computer rationalization. (If one needs help with this, see the One-Footed Bride c/o GOAM, p 155.) The fact of the matter is that the "real" notes cannot be transposed (as in any "tempered tunings") and neither can the real existence of the harmonic identities of any "acoustic" noise occurring in real time in a real place be realistically replicated, duplicated, recalled, or imitated by any electronic contrivance now (or maybe ever) existing.

The psychedelic panorama of 12-equal noise on television, the constant sounding badly represented tones identified with the promotion of some idiotic product, which is then abandoned because of the network demands to bring up still another one the next second, is enough to disorient anyone, no matter how sensitive or obtuse they may be. I think its slowly driving any of us who subject ourselves to it crazy.

If you have the technique on a 12-equal instrument, play along with the noise from your TV for ten minutes. If you can keep up, surely you will perceive how confusing this is to the layman, and confounding to the trained musician. It is free modulation, randomly rarely in tune with A = 440. In a brief period of time one can be exposed to perhaps 400 subdivisions of the abstract octave. This is the exact opposite of the musical experience which has been a major factor in the evolution of mankind.

I want to encourage everybody with ears to seek out recordings of non-western music, particularly North Indian classical, since, while it may ultimately be the best, it has at least enjoyed the widest distribution. It is reasonable to assume that many cultures produced musics which had large compositional schemes utilizing a wide range of improvisational/intonational/expressive identities. The fact is, whether through manifest destiny, cultural contamination, or just plain bad memories, most have been forgotten. Except for isolated examples like the bizarre Indonesian big-band experience (the Gamelan, which does not allow for much improvisation), the only readily available music now living (and just now dying) that displays the broadest range of the old tools for personal exploration of the sonic environment is North Indian classical. I admit I am fearful about the loss of the chance to find out for oneself. The modern race for technological superiority (the capability to blast everyone into sonic or some other kind of submission) is quickly obfuscating the old values beyond recovery. While there are strange isolated examples of the old musics still available on records, your best chance to hear - at least in my 30 year collection - a realistic display of how to make something from nothing is to explore North Indian classical.

Let me restate this: the eager spousal by less modern cultures of the latest mechanized megabuck noises forced upon them by our "stylish" encroachment into their environment is destroying the germs of these sounds, which took thousands of years to evolve, like a virulent antibiotic, comparable to the felling of the rain forests by us, this nasty little poisonous horde of humans. Once they are lost, we'll all be the same, with no differences to share. Not only will we have

I MUST COMPLIMENT YOU on your comparative tunings chat/chart [EMI Vol. VI #2]. Even the casual reader should perceive that no matter which note you like the best, the graph implies that only Hindustani music and the Blues are systems which allow for pitch choices which might imply (personal, momentary) alternative emotions. (To anyone who brings up Uncle Harry at this point: why are you even reading this? Shutup and get busy.) In this is the supposition that you might have an idea of your own and find a note with



Graphic by
Robin
Goodfellow

no more "soul;" it won't rain no mo'.

My reasons for this acoustical suggestion to potential constructionist/experimenters are:

1. The sound is real
2. The available tools are profoundly less expensive and more diverse (albeit labor intensive)
3. Unless your resources are unlimited and your technical training extensive (beyond belief), you can help yourself to a much more satisfying variety of sounds in this way
4. Yes, it is easier to plug in a bunch of junk and let the electronic mind "hear" for us, but this precludes the development of **your** musicianship, and I mean the singular, not the "us"

5. If you are truly infected with the sonic expression virus, you must persevere until you have done your best to connect with the cosmic note. (Being non-sectarian, I'll leave you to name IT for yourself.)

I would like to append the Comparative Tunings Chart with a lateral rhythmic bottom line. If one envisions "the notes" as a vertical structure, I suggest their simultaneous and codependant existence in the horizontal (temporal) realm. Don't be alarmed; this is easier than the pitches: just set up an adjustable rhythm source (a metronome) and learn to stay right with it, and then learn to generate 2 against it and then 4. Now try 3/1. Try 3/2. Try 6/2; see! you already know. Now generate 5/1. This is harder, you must give some time to it. Just to make sure, generate 5/2. Now make 7/1 and 7/2. Welcome to the simple rhythmic octave and I think you'll find 8/8 (1/1) real easy. (1-8 must not be "phrased", i.e. subdivided - such as 2-2-3 for 7 or 3-2 for 5, each integral identity must stand alone against "1.") If you practice this to the extent that you can maintain your integrity and then lapse behind or advance to varying degrees beyond the set pulse and perceive the expressive potentials available, I guarantee that not only will the "world musics" seem much more natural to you; you will begin to acquire a reputation among your friends for having "good time." (What is the most easily recognized quality of the music called jazz? "It 'swings'!" For almost 100 years now the hipsters have been mocking the "outsiders" because they can't get with "it.") If you want to understand American rhythmic swings, listen to some 20s and 30s Louis Armstrong and Duke Ellington and then some '36-'39 Lester Young. Then review and practice the first part of this paragraph. If you would like to try Hindu swing, get something by Nikhil Banerjee.

Tom Baker

NOTES FROM RECENT CORRESPONDENCE

The *Chicago Invented Instruments Festival* is taking place in November and December. Spencer Sundell, a director of the event, sends this information:

The First Annual Chicago Invented Instruments Festival will combine a series of hands-on workshops (taught by Hal Rammell), film and video presentations, and two nights of concerts at Club Lower Links (954 West Newport in Chicago). The month-long event is co-sponsored by Lobe Hatch, Experimental Sound Studio and Club Lower Links.

The festival promises to be a unique musical experience. Designed to encourage the creation and and enjoyment of instruments and sounds that exist nowhere else, it will provide a delightfully mind-opening alternative to musical standardization. Fascination with invented instruments crosses all boundaries of age and taste -- they are used in everything from folk to avant garde. They are even exhibited as sculpture in galleries and museums. Paradoxically, playing of the instruments in a specialized concert setting is unusual, making this event all the more unique.

WORKSHOPS AT EXPERIMENTAL SOUND STUDIO

Instrument Invention and Sound Exploration is a special Visiting Artist Workshop to be taught by musical sawist, instrument builder and author Hal Rammell. Running weekly from Monday November 19 through Monday, December 3, 1990, the workshop is for anyone interested in designing, building

(continued overleaf)

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SUBMISSIONS: Experimental Musical Instruments welcomes submissions of articles relating to new or unusual musical instruments. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

and playing unique acoustic sound sources using recycled and found materials and simple building techniques. No special playing or building skills are necessary. Participants in the workshop will be invited to play their instruments at Club Lower Links during the concert nights. Cost for the workshop is \$85.00 (\$70 for students and ESS members.) To register or for further information, contact Lou or Dawn Mallozzi at (312) 929-0478.

CONCERTS AT CLUB LOWER LINKS - FRIDAY DECEMBER 7 AND SATURDAY DECEMBER 8, 1990

Scheduled to appear in the concerts are: Don Meckley and Hal Rammel, Mark Messing and Mark Howell, Don Malone, Dina Morelli, The Wisconsin Conservatory of Noise, and Peter Voutsanesis, with additions to follow. Between each musical performance, rare film and video clips will be shown, featuring the likes of Spike Jones, barnyard orchestras and relevant cartoons. A detailed program with information about the artists and their instruments, plus information on related books, recordings and publications will be distributed. A sampler cassette featuring some of the performers and their instruments will be made available to interested radio stations, critics, writers, et al.

For further information on the **Chicago Invented Instruments Festival**, contact Spencer Sundell, 1340 W. Irving Park Rd., Suite 164, Chicago, IL 60613; or call him at Club Lower Links (312) 248-9496 or (312) 248-5238.

READERS MAY RECALL the photographs of a large street organ in Amsterdam which appeared in the letters section of our last issue (EMI Vol. VI #3). Tom Nunn, traveling in Europe, had taken the pictures and passed them along to EMI; they tied in nicely to a report on mechanical instruments that had appeared in the previous issue. By coincidence, Colin Hinz took some shots of similar instruments during recent travels as well. He writes --

Here are photos of orchestrions I saw in Europe. The one in Amsterdam is really quite amazing -- huge, lush sound and a really beautiful instrument besides.

The civic museum in Den Haag has a very large collection of musical instruments -- from Renaissance lutes to strange avant garde instruments and Fluxus constructions. They also have an extensive collection of automatic instruments, which focuses on pin-cylinder instruments of the 19th century. Well,

that's what I know from the extensive set of catalogues (half a dozen volumes) available -- the museum itself is closed until next March (damn!).

A DOZEN WOODSTOCK CHIMES sounded in Carnegie Hall in October as part of Carnegie's Centennial Celebration. They were part of Toru Takemitsu's composition **From Me Flows What You Call Time**, performed by the Boston Symphony Orchestra and members of the percussion

group Nexus, in a premiere performance under conductor Seiji Ozawa. The chimes were suspended above the balconies on either side of the auditorium, with multicolored ribbons floating down to the musicians. Woodstock Chimes are designed and manufactured by long-time EMI subscriber Garry Kvistad; the company's publicist sent along this photo of Garry & chimes standing proud in front of Carnegie Hall. For information on the full range of instruments



Garry Kvistad and Woodstock Chimes
Photo by John Kleimann

they manufacture, write Woodstock Percussion at West Hurley, NY 12491-9602.

HOMEMADE INSTRUMENTS ARRIVE: The Brazilian group UAKTI appears prominently on Paul Simon's recently released album, **The Rhythm of Saints**. Members of UAKTI, led by Marco Antonio Guimaraes, play an impressive array of instruments of their own construction and design. Most prominent among them are large percussion tube sets (similar to those described in this issue's **From Scratch** article), which the UAKTI people play with astound-



Left: Orchestron in Paris.
Right: Orchestron in Amsterdam, made by Anton Pliet, date unknown; restored 1984.

Photos by
Colin Hinz

ing virtuosity. Several of UAKT's own records can be found in the Brazilian import bins at adventurous record stores.

EMI GOES DP

This issue of **Experimental Musical Instruments** is the first that has been laid out and printed using desktop publishing software and a laser printer. Prior to this we have used traditional cut-and-paste methods, with text produced on a good old workhorse of a daisy wheel printer. Our new face, inevitably, is somewhat different from the old, but we have tried to maintain a similar spirit and avoid suddenly jumping to a computer-generated look.

For those who may be interested: The software is Ventura Publisher; the printer an Okilaser 800 with some extra memory; the typefaces are Times, Helvetica, ITC Souvenir and Futura Light; and we've used an inexpensive hand scanner (Mars 105) to input some of the graphics.

CORRECTIONS

Cris Forster writes:

In the article "Wound String Calculations" (EMI Vol. VI #3) page 16, the slug/in. masses for bronze, nylon, and steel should have read .00000631 slug/in., .00000039 slug/in., and .00000334 slug/in. respectively. These results are obtained if the previous equations are divided by 32.2 ft/sec², instead of 386.4 in/sec². However, these technically correct values for slug/in. must be divided by 12 in. to give the results of .00000053, .00000003, and .00000028 as stated in the article. These latter numbers must be used because the **inch** is the unit measure of the string. The problem is that as mass numbers they do not have a name in the English system. They can be understood as 1/12 of a slug/in.

In the article "The Evolution of an Instrument: A Work in Process / A Catalyst for Musical Development" (EMI VI #3), author Tom Guralnick's name was misspelled, with the C omitted. Sincere apologies to Tom and to readers.

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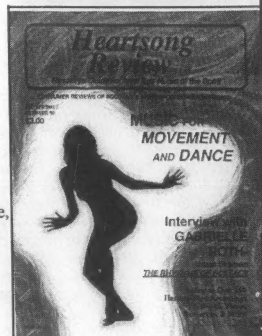
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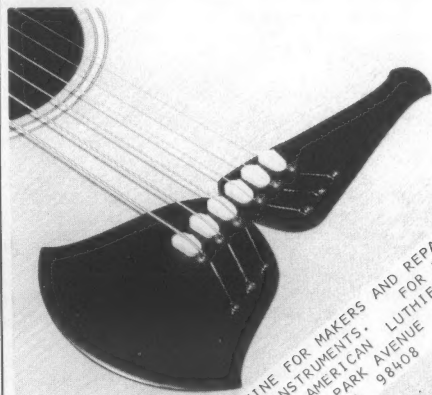
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PLAYING MUSIC WITH ANIMALS

Four Passages from Dolphin Dreamtime

by Jim Nollman

(continued from page 1)

player, just so they won't sink in the water. Even a human can hear them underwater from fifty yards.

The Waterphone will be familiar to many of EMT's readers as the extraordinary friction-sounded bronze rod instrument invented by Richard Waters. The instrument is all stainless steel and bronze, and works well under water, or, alternatively, resting on the surface of the water so that its vibrations are transmitted from the base of the sounding vessel into the water. Its sounds can be very much reminiscent of whale songs.

The whalesinger drum, a floating boat-instrument, is described in the second of the passages that follow.

An electric guitar may seem an unlikely candidate for underwater music, but Jim has set up a sound system to project into the water the sounds of the instrument played above board. Played with a slide, the guitar acquires some of the flexibility of whale songs. Jim's long standing facility with the instrument also played a part in his decision to use it. The underwater speaker was designed for swimming pool use by Lubell Labs of Akron, Ohio.

Finally, and perhaps most importantly, we have the underwater sound system that allows for monitoring and recording, as well as transmission of underwater sound. Here is Jim's description:

"Our sound system has been constructed, added-on to, maintained and sometimes broken, by four different engineers over the past ten years. Its present incarnation is a splendid piece of hardware designed and built for Interspecies Communication by SeaAcoustics, a company which is, sadly, now out of business. It consists of three waterproof "pelican" boxes -- one each for transmitting, recording, and monitoring. These boxes connect to one another as well as to all outboard gear (guitars, hydrophones, power supply) by waterproof audio connectors made by Ikelite and probably developed for use by the petroleum industry. The hydrophones (underwater mikes) were also made by the now defunct SeaAcoustics.

"The entire system runs off twelve volts, which is standard on most boats. Furthermore, the so-called transmit box has enough inputs and outputs to serve as a standalone unit for those times when we need to travel a bit lighter. It is just small enough to serve as carry-on baggage on an airplane. We use it alone when working in open boats, or in inclement circumstances. For example, we mounted an expedition with beluga whales in the high arctic during July 1990, doing all our work from the platform of a 16 foot zodiac.

"However, for those times when we use a larger boat (we have been working with orcas from the platform of a forty-foot boat for a month each summer over the past twelve years) we opt for the entire system. For example, the recording box contains a very good parametric equalizer which lets us notch out the staticky sound of shrimp or the low rumble of fishing boats. And the monitor box lets us wire up an entire boat for

underwater sound listening. When the orcas swim past at 4 AM, vocalizing at a volume of up to 120 dB, they make for very bizarre dreams before finally waking us up.

"For the future, we have plans to build a box to contain a radio receiver. This would let us wire a hydrophone to a buoy with a transmitter so we could get much better sound separation during the recording process. It would also permit monitoring from several different places at the same time. We're now looking for someone to build this system for us."

For this article we have selected four passages from Jim Nollman's book, *Dolphin Dreamtime* (New York: 1987, Bantam Books). The excerpts come from different parts of the book; they describe events from different times and places; they recount experiences with different species; and they represent different stages in Jim's developing sense of how to approach animals musically. We begin with a Zinacantan yard bird ...

Spring, 1972

Mexico offered cheap living, warm weather, and carefree music making. After months of traveling, I finally set up house in the town of San Cristobal de las Casas, very near the Guatemala border. It was an area rich in a very old native musical tradition. Within a few weeks I began to study these traditional Indian songs, on an old guitar, as well as on a local Zinacantan pottery flute.

And every time I hit a certain high note on that flute, the tom turkey who lived in the yard of my next door neighbor would let out a single resounding gobble. It was positively uncanny. It was as if the turkey had found its own place in each song, and then joined in right on cue. The third or fourth time this occurred, I ventured next door to meet the very musical turkey face to face. There he stood -- fat and brown, red skin drooped over his nose, tail spread wide like a fan. When I began to play the song, the turkey first stared, then dropped his wings right into the dirt. Then he shook his wings vigorously, raising a small cloud of dust. He advanced step by haughty step in my direction -- four steps forward, then four steps back. Every so often, the red wattles on his throat suddenly turned a deep blue color; and then, just as quickly, they returned to red again. And every time I hit that certain high note at the end of the song's third measure, the turkey let out a single, solitary gobble.

Over the next month, I spent about an hour a day playing strange songs and stranger sounds with that turkey. I learned quickly that the bird was not actually singing with me, but was, rather, responding to the intensity of the notes. Intensity meant a relation between high pitch and loud volume. But this relationship between volume and pitch was never constant, and would some days differ quite dramatically from what I called the "trigger note" of the day before. I speculated that the change was due to a blend of weather conditions and the turkey's own composure. When it was hot, the bird gobbled sooner and more often. Neither was the response directly related to musical sounds. One day a truck sans muffler drove up the street, waking me from a blissful siesta. From next door I heard the turkey go into one of its gobbling



tantrums, like a hysterical child unable to stop crying.

Despite the bird's apparent indifference to the source of any sound, it would, nevertheless, allow itself to be carefully programmed into the body of a particular song. All I needed to do was properly accentuate certain key notes by pitch or volume: **ta ta ta ta TA (gobblegobblegobble) ta ta ta ta.** And there was method to this madness. If I accented too many notes in quick succession, hoping for a crescendo of gobbles, the turkey soon reached his own breaking point, and trotted off in either fright or disgust, as quickly as his two plump legs could carry him. The first time this occurred, a fat woman, with a small child in tow, rushed out of her house to scold me in quicksilver Spanish for upsetting her pet. After all, she was fattening the bird for an upcoming Easter dinner, and could not stand by while my frenetic style caused her turkey to lose weight. For my own part, it was a rude awakening to learn that my playing companion would soon be served up in the traditional sauce of chocolate and chile.

Upon further questioning, the woman confessed to me that turkeys like to be serenaded the same way that cows do. "Ride the turkey energy," she advised. "Ride the energy the same way a surfer rides a wave."

... I left Mexico, and journeyed back to the San Francisco Bay Area. There, I convinced a benign radio station, KPFA, to commission me to produce a piece of recorded music with turkeys. Sensing the potential humor of such a strange musical offering, they agreed to provide for all my recording needs. On the day of the recording session, held at the Willy Bird Turkey Farm, I experienced the incredible phenomenon of three hundred turkeys all answering a trigger note in perfect unison. I sang the traditional folk song "Frog-

gy Went a-Courting;" and every time I enunciated "Uh Huh, Uh Huh," all three hundred toms responded with a veritable ocean of gobbles.

The edited two-hour recording became "Music to Eat Thanksgiving Dinner By," played over the airwaves at 3 PM on thanksgiving afternoon. It became a kind of new wave Muzak for families gathered together to share the traditional American turkey dinner.

And the music was a hit. Friends encouraged me to continue to explore the connections between music and animals. So over the next full year, I spent time sitting with bobwhites in Ohio, kangaroo rats in Death Valley, and a pack of wolves at a refuge in Nevada. Each species related or reacted to the music sessions in totally unique ways. I was pleasantly astonished when the wolves would cease howling whenever my musical answers to their own singing was off-key. Next, an art patron invited me to the Big Island of Hawaii to try out my emerging techniques with the wild dolphins who lived just off the coast. One day, the dolphins came to me as I played to them. And so, a relationship with a particular species was born. In the years since then, I have developed this musical communication with several other species of dolphins and whales, as well as a score of land animals.

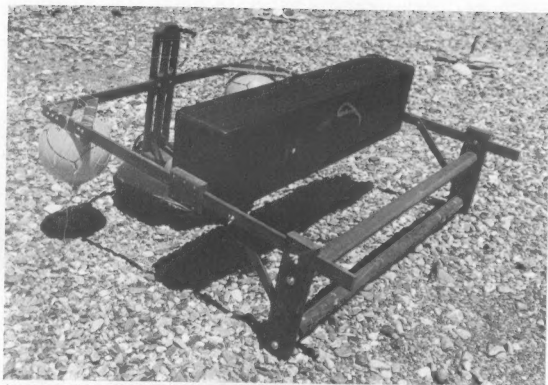
Winter, 1976-77

It is invigorating floating around in the open North Pacific Ocean. I am thirty yards from the rubber boat, lying flat out on my back, rubbing this carved "whalesinger drum," this interspecies musical instrument, descended from the Native American tone drum, the **tulke** of the Maya, the **tepanatzli** of the Aztek. The sound is generated by rubbing the various

wooden surfaces of the box-shaped drum with a mallet tipped with a dime-store superball; something like scratching chalk against a blackboard, but much more mellifluous. Different sized superballs emit different pitches, textures, and registers of sound. The giant red, white and blue superball moans ever so deeply, and sometimes clicks as well, if it is bounced and rubbed at the same time. The technique for this is quite tricky and it took several days before I had mastered it. The medium sized cat's eye superball sounds roughly akin to the human voice. But it is a voice of rubber and is ever so long-drawn-out, like a whale's. A whale human. The small Day-Glo orange superball screeches like a elephant, but not quite so harshly. All these sounds, taken together, evoke any and all the whalesongs that you or I have heard; either in reality, or in the deepest recesses of your animal dreams.

The whalesinger has been equipped with an outrigger which keeps the instrument from tipping and drawing water through the tuning slits which have been cut into the top face of the drum. It also gives me a snug little frame to put my body inside of, and thus be totally supported while riding through the swells. This is more than a case of becoming one with the instrument. The swells can get as large as twenty feet. It is not the tops of the waves that bother me. Rather, it is the valleys between the swells, when I cannot tell for the life of me where either the boat or the shore has gone to. I am not out here to test the hydrodynamics of slit drums. Neither am I out here because I enjoy three-hour immersions in 42 degree water. Rather, I am here because I believe that humans can communicate to whales.

At this point in the long term venture of interspecies communication, it seems essential that I play this music from



Above and below left: Jim Nollman and the Whalesinger Drum

directly within the whale's own watery environment. So here I float, a mile offshore of the rugged Point Reyes Headland, working up a musical sweat, making whale-type sounds with all my body and soul. And the gray whales, these forty-five foot living express trains, are all about as they continue along their leisurely four-thousand mile swim from northern Alaska to the warm harbors of Baja California. There they spend a toasty two months: congregating, courting, making love, and making babies. Once the babies are born and taught a bit of practical seaworthiness, the grays turn about an immediately head back up the coast to northern Alaska again.

Watching the spectacle of this migration has developed into quite an environmental event at various headlands along the coast. To promote both the migration and the plight of the whales worldwide, former governor Jerry Brown of California sponsored a series of events called "California Celebrates the Whale." As one part of this, the state hired a group of innovative design consultants, collectively known as The Ant Farm, to design some program that would bring the event of the gray whale migration closer to the people. The Ant Farm, best known for such arty-type works as the Cadillac Ranch (a monument to the tailfin) and the House of the Century, which looked vaguely like an electric shaver, went to work. They designed and built an underwater public address system that would make the sounds of the gray whales audible to listeners on shore. The hardware consisted of a buoy containing underwater microphones known as hydrophones, connected to radio transmitter. The signal could then be received by any radio with a public service band, from as far away as two miles.

Unfortunately, the gray whale is known to be one of the less vocal whales; most of their vocalizations occurs in the harbors of Baja and in the waters off Alaska -- in other words, anytime they are not migrating. If the Ant Farm's project was going to succeed, they would have to devise some technique for coaxing the whales to sing. Since I was enjoying a modicum of success in my playing with dolphins, The Ant Farm hired me as their musical director. I was to wield the baton. My chorale easily outweighed the Mormon Tabernacle Choir. Nine times during the months of December and January in 1976-1977 I slipped into my wetsuit, draped my arms and legs around the whalesinger drum, and slipped into



the waters of the Pacific Ocean. The music that I made on the drum resonated out through the bottom of the instrument and thus directly into the water. On several occasions it attracted the attention of passing gray whales. Sometimes they came so close that I felt as if I could reach out and shake their hand. It had something to do with their eyes. They did not sing.

August 1979

The third night evolved into pure magic. The session began at 10:30 pm, the same as the two previous nights. And as the night before, the orcas were there promptly at 10:30. I began by simply mimicking on the guitar the standard vocalizations of the pod: a three-note phrase that begins and ends on a D. But this pattern is never frozen. Rather it varies in form by the addition or deletion of the speed of the glissando, by the fluidity of the legato. In other words, the orcas' own language varies just exactly the same way that a jazz musician varies a standard melody. And the whales seemed very aware of my own attempts to vary their own song by ending each of my phrases with a solid obbligate amen of D to C to E to D.

Unfortunately, the highest note available to my electric guitar is a mere C#, an impenetrable half-step universe below the orca's tonic note. Thus, in order to reach their register, I needed to bend the high string -- something ordinarily not that difficult -- but, in fact, rather clumsy to achieve hunched up in the dark fog while fingering up at the very top of the guitar neck. The first time I attempted the bend, the result sounded like a respectable approximation of the orcas' own phrasing. Actually, to be totally honest about it, if the whales had been saying, "Try again, you ignoramus," then I replied "Twa wawa woo inwawawa." But I chose to remain undaunted by such matters as content, and so repeated the phrase a second time. Suddenly, the high E string snapped. While I sat there in the thick night air fumbling through my guitar case for a fresh string, the orcas stepped up the intensity of their vocalizations. Calling, calling for me to rejoin the music. Every so often one would punctuate a long sinuous phrase with their standard call.

I tightened up a new E string, and stubbornly plucked out the orca's signature call, but this time in C# instead of D. The center stage orca immediately answered by repeating the phrase in C#. Otherwise, it was the exact same melody. From that point on, the dialogue between us centered around the common C# scale. And the conversation continued for more than another hour in very similar fashion.

March, 1983

Less than an hour after we had first heard the dolphin's own rendition of a fish rhythm*, it became clear that there were three dolphins playing around the boat, and that each one possessed an individually identifiable voice. One voice in particular stood out from the other two. It was slightly deeper and more resonant, and it seemed to be leading the other two. Several times, the lower-voiced dolphin initiated

* This passage refers to a clicking sound produced by a certain species of bottom fish at that time of year. Dolphins in the area had taken to producing a similar sound, but with patterned rhythms, in contrast to the seemingly random clicking of the fish themselves. The author devised a method for projecting his own click sound into the water by plucking the damped strings of an electric guitar hooked up to underwater speakers.

Playing guitar from above board



a sequence of fish rhythms, which the other two repeated in nearly chorus-like precision. When I first heard this "song," I decided to remain silent -- to listen and learn for a future encounter.

The next day, after playing fish rhythms on the guitar for about a half hour, five dolphins swam into sight for what was to prove a quite lengthy session. The fish were clicking, I was clicking back: **one-two-one-two**. Suddenly the low-voiced dolphin began an incredibly precise meter: **one-two-three-four--onetwothreefour**, repeated over and over again. Furthermore, the rhythm itself seemed to be based in the key of D-major. Inexplicably, and without a thought as to how I might best answer the dolphin, I began to play "Misty," also in the key of D.

It continued this way for about a half an hour: the fish droning away like the background to an Indian raga; the lead dolphin keeping a precise **one-two-three-four--onetwothreefour**; one or another of the other dolphins repeating that rhythm in chorus; other dolphins whistling; and a guitarist breezing through the strains of "Misty." If nothing else, the fish, the dolphins, and I had achieved the beginnings of a band that might be able to make a living playing weddings and Bar Mitzvahs.

*Interspecies Communication, Inc., a 501(c)(3) tax exempt corporation, is located at 273 Hidden Meadow, Friday Harbor, WA 98250. The Interspecies Newsletter is published quarterly, and comes with a \$25 membership in the organization. Orca's Greatest Hits, a cassette tape of music with animals recorded during several Interspecies Communications projects, is available for \$11 from the same address. A recording of Jim Nollman's turkey music has recently been re-released on an LP entitled **A Fish That's a Song** from Smithsonian/ Folkways records (SF45037).*

*In addition to **Dolphin Dreamtime**, Jim Nollman's new book, **Spiritual Ecology**, is available from Bantam Books in paperback at \$9.95.*

FROM SCRATCH

A Background Introduction

By Phil Dadson

*Phil Dadson is an artist/composer and founder of **From Scratch**. He has toured and performed widely with the group in New Zealand and overseas. He teaches time-based arts at Elam School of Fine Arts, University of Auckland.*

From Scratch is a New Zealand group formed in 1974. In its early days, the group experimented with sound and form in musical and visual ways using home-made instruments and simple repetitive rhythm structures. Over time the music has increased in complexity and sound color. Densely textured rhythms form the core of lengthy works which are part music and part theatre, ritual, movement and sculpture. A distinct performance language has evolved, though the music remains based around instrument invention and a rhythmic vocabulary similar to that with which the group began.

A **From Scratch** performance is characteristically visual as well as aural, in that the sculptural look of the instruments, the simple lighting, and the movement of the performers are as much a feature as the rhythmic ideas. Anyone asked to describe a performance will invariably begin with the look of the instruments and the interaction of performers.

The players are equal in status. They share a similar range of performance roles and there are no principal soloists as such. The visual placement of the instruments is important. It suggests simple shapes reflected in the structure of the music. What you hear you also see and vice versa.

Compositions are highly structured and invariably seamless, in that they move through contrasting modules of rhythmic/melodic material without a break, for up to an hour or more.

As the group's aesthetic has evolved from less to more structured, its tonal vocabulary has gone from random pitches to finely tuned. The instrument making has graduated from assemblies of found objects to carefully designed pieces. Central in this development have been the 'tuned percussion stations'-- rack supported four-tier combinations of PVC pipes, tuned chimes, roto-tom drums and tuned-tongue bamboos. First four and later three of these stations, along with various other struck and spun acoustic instruments, made up the **From Scratch** sound.

In recent months, after a temporary layoff, the group has reformed, and a range of new instrument and performance possibilities are being explored. These include new PVC, stringed and wind instruments, fresh musical ideas, and experiments with film and video. While the repertoire and performance skills are continually evolving, the group still features PVC percussion aerophones in one form or another

as the **From Scratch** logo.

The following instrument descriptions begin with the tuned percussion stations as composite instruments with considerable versatility, then move on to some of the other instruments which complement the stations, and finally touch on recent developments.

FROM SCRATCH / INSTRUMENTS

There's nothing quite so exciting as building a home-made instrument and using it for making your own music, and the physical world is one huge resource for percussion players.

While the industry trend is towards increasingly sophisticated and miniaturized electronics and computers, **From Scratch**'s direction has been towards natural acoustics and often large sculptural constructions with natural and industrial materials. The most developed of these are our tuned percussion stations. Each of these stations is a set of percussive sound sources, arranged and designed to be played by a single player. We use three such stations, each containing the same sound source sets, but in different pitch ranges - high, medium and low. Within each station, plastic, metal, wood and skin are represented in four separate tiers. From top to bottom, the arrays are: 14 end-struck PVC pipes, 14-20 tuned chimes, 6-8 tuned-tongue bamboos, and 6-8 tuned drums. With the long PVC pipes dominating visually, the whole arrangement looks like a giant pan pipe.

In performance, each player stands at a station, with all the sound sources arranged in front and to either side like a big switchboard. The pitches in each tier are laid out low to high, left to right. To get different combinations of sounds the player has to make different shapes with his or her movement in space. As repeating rhythmic patterns swing from high to low and back again, the player sets up a kind of rhythmic semaphore that is as much a part of the piece as the sound is, and playing this instrument keeps you fit!

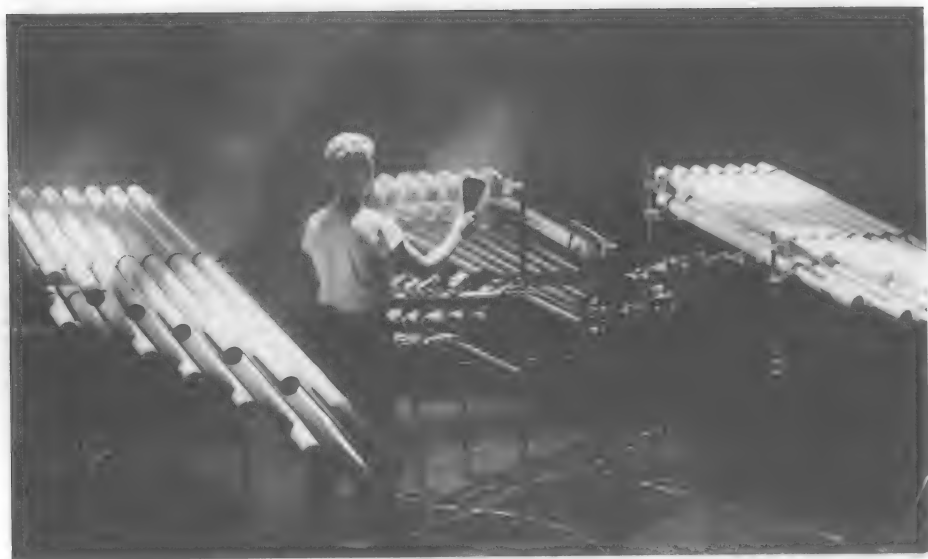
Each station, with its easily accessible and different tonal layers, ideally permits the substitution of any one tuned source for another in performance. Rhythmic/melodic lines are enriched by this potential, where a type of hocketing can be achieved by one player. Two or more stations in combination can produce an intricate hocketed texture (as in the 7 sections of the piece "Gung Ho 1,2,3,D").

COMPONENTS OF THE PERCUSSION STATIONS

End-Struck Pipes

The end-struck pipes that form the upper tier on the percussion stations are very long sections of large diameter plastic tubing, open at both ends, positioned horizontally with one end toward the player. The fourteen of them are cut to length to form a tuned set. We play them by striking the open ends with a broad, flat rubber bat. This excites the

NOTICE: PVC, or polyvinyl chloride, is toxic. Precautions should be taken in using it, particularly in heating, cutting, and sanding, or where there may be oral contact.

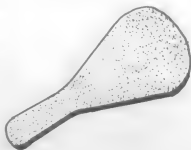


air within the tube, producing a clear and strong tone at the natural resonant frequency of the pipe. Some percussion tone -- the un-pitched slap of bat against plastic -- is inevitably part of the mix as well. This increases the percussive quality of the total sound and gives it stronger rhythmic definition. But the softness of the rubber bats ensures that the slap sound is not dominantly loud. The softness also allows the surface of the bat to conform to and cover the open end of the pipe at the instant of contact. This enables it to move a lot of air, ensuring a good, strong, definitely-pitched tone.

For our bats we use a rubber lamination similar to that used for beach sandals -- variously called jandals, flip flops or thongs. The lamination is about 20mm thick and we cut them (as illustrated) to about 280 mm long. Ours have one of the contact surfaces slightly harder than the other, and the two sides produce different sounds. The harder side has more punch and slap combined with the tube tone, and the softer side is more mellow. We use one in each hand and the playing technique requires that you strike the end of the tube accurately, fully covering the hole, and remove the bat immediately, a wrist action similar to knocking on a door.

For smaller pipes, such as the hand-held PVC percussion tubes described later in this article, a softer rubber bat is called for. With very soft rubbers there is virtually no slap, which is important with the smaller diameter pipes where the tone is not as full. We purchase a softer rubber from the manufacturer and cut it to size. It's very expensive but worth it for the sound.

The chart below gives the diameters and approximate



lengths for PVC pipes in the percussion stations as we have them set up. Note that the speed of sound in air varies with temperature, and this in turn affects the sounding pitch of a pipe of a given length. The pipe lengths given above are for the hot extreme. We learned about this the hard way in Papua New Guinea (South Pacific Fest'Arts 1980), where the heat raised the tuning of the pipes a good semitone.

To allow the pipes to accommodate varying temperatures, a tuning sleeve is fitted to each one, and tuning of pipes is done prior to any performance. The tuning sleeves also

Inventory of pipe sizes and lengths used in the *From Scratch* high, medium and low Percussion Stations.

65mm	2170mm	D	E	F#	G#	A#	C	D
	2410mm	C#	D#	F	G	A	B	C#
65mm	2115mm	B	C#	D#	F#	G#	A	B
	2160mm	A#	C	D	E	F#	G#	A#
80mm	2160mm	G#	A#	C	D	E	F#	G#
	2160mm (extension)	G	A	B	C#	D#	F	G
80mm	2160mm	G	A	B	C#	D#	F	G
	2160mm (extension)	G	A	B	C#	D#	F	G

The above lengths are not exact for 12-tone equal temperament. Adjustable sleeves are necessary for fine tuning purposes. On the low station, three extension pipes are required for low G, G# and A. G, e.g., has an extension pipe of 590 mm, plus sleeve.

allow for tuning to alternative scales. For the 65mm diameter pipes we use outer adjustable sleeves approximately 120mm long. These were made by heating (dry heat or boiling water) one section of pipe and forcing it over another of the same diameter. (There is a heating point at which PVC will expand without collapsing. Important: please observe the cautionary note on the first page of this article). Some fine sanding is necessary to get a snug sliding fit. For the 80mm pipes we use an inner adjustable sleeve approximately 200mm long. Here in New Zealand there are two main producers of PVC pipes. Selected lengths of 80mm downpipe from one manufacturer happen to fit snugly inside the downpipe made by the other, and this conveniently solves the tuning sleeve problem for the larger pipes.

It takes a little experimentation to get tuning inserts which are a good fit yet moveable. Once positioned, the sleeves can be held in place with a small piece of cloth tape on the underside.

For pitches requiring lengths greater than the standard manufactured pipe length (as with the bottom four notes of the low station), we use extension pipes with joining rings, and adjustable sleeves in the ends.

In addition to playing the pipes with open ends we sometimes place a membrane over the ends to change the tone and allow the use of mallets. The sound is quite different from open pipes. At first we used plastic cups. This gives an interesting but indefinitely pitched tone. Later, we improved this by using a high strength flexible plastic (lexan). A disc is attached to each pipe with an air space in between. The disc is thin and very strong. It is secured to the pipe at three points by modified rubber pegs. The diaphragm is then separated from the tube edge by an air gap and operates similarly to the way resonance mouth-clapping works. An impact shock wave activates the air cavity resonance, in our case the air column. The result is a sound similar in pitch to the end-struck pipe, but different in tone quality. We nicknamed the caps "quackers" in reference to their sound.

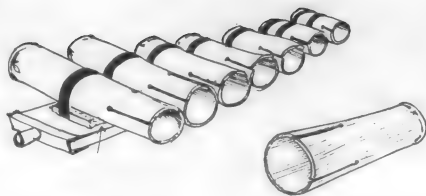


Tuned Tongue Bamboo

The third tier in our percussion stations (we'll get to the second in a moment) is a tuned array of bamboo tongue drums, inspired by Harry Partch's BOOs. We wanted a warm wood tone to add to the PVC, metal and drum combination, so when some large size dry bamboo came our way, tuned tongue bamboos were the result.

Our sets use sections of large diameter bamboo ranging in length up to 550mm, closed by a natural node or other stopper at the far end. The near end is open, with a pair of longitudinal slits running from the open end in the upper front portion about 120 degrees apart.

The section between the slits forms the tongue, free to vibrate much like the tines on a kalimba. The player strikes the tongue with soft or medium mallets. In addition to the tongue tone, the air enclosed within the bamboo has its own natural resonant frequency as well, determined by the length of the tube modified somewhat by the slits. When acoustic coupling is achieved between tongue tone and air resonance, the instrument comes alive with a sound that is clear, short,



dry but mellow. For interested readers, instructions for making these tubes appear as an appendix to this article.

We mount the bamboos, 7 or 8 in a tuned set, arrayed low to high, left to right, on a cross piece affixed to the base of the percussion station.

Tuned Chimes

Just above the bamboos are the tuned chime sets. We have mostly used a commercially available chime called "Dulcet" as they are clear toned and easily interchangeable. However, I have also made test metal versions of the tuned tube bamboos, and may someday replace the dulcets with a full set. The test ones are made of square section aluminum (40mm) stopped at one end. Unlike the bamboos, the two slits are opposite one another on the tube, creating not a single vibrating tongue, but two matched halves. The halves work in tandem much like the two arms of a tuning fork. The chimes differ from tuning forks, though, in that like the bamboos the tone is sweetened and strengthened by the tuned air resonance of the tube itself.

Tuned Drums

With tuned drums we've taken the easy option -- the roto-tom tunables. They're not cheap, but they are effective when tuning matters.

The heights and positioning of the four tiers of the percussion stations are adjustable to individual needs, and for this we use scaffold construction fittings, adjusted and fastened with an allen key. Our final addition to the stations are pairs of cymbals (traditional and aluminum discs) mounted one on each side of the uprights at the business end of the stations

OTHER FROM SCRATCH INSTRUMENTS

A range of other instruments have also been devised to complement the stations, and these include a wide range of spun acoustic drones and various hand-held tuned percussion. The spun acoustic drones have been an integral part of **From Scratch** music since the mid-seventies as both visual and sounding accompaniment to the percussion. In performance the instruments dramatically stress the circular and repetitive shapes of the music. **Experimental Musical Instruments** has recently had a fine series of articles on whirled music, and as our instruments are similar to many of those described I won't repeat material that was covered then.

Hand held instruments include various small bore PVC pipe instruments; e.g., clusters of tuned-tongue PVCs (exactly the same principle as those described for bamboo, although the tone varies considerably with the type of PVC wall used), and clusters of pipes both closed at one end and open at both. They use PVC of diameters of 30 to 50mm, in

lengths in the range of 750mm to 480mm. We make them in chordal clusters: three or more tuned lengths are fixed together and end struck, all at once, with a soft rubber bat. These smaller pipes may be open at both ends or closed at the far end. (A pipe closed at one end will produce approximately the same note as an open pipe twice its length. There is a slight difference of tone.) Short lengths with one closed end are not very satisfactory: anything less than 500 mm long (diameter 40-50 mm) produces more contact sound than tone. A variation on these is to glue a very thin plastic membrane to the end of one or more pipes producing a very adequate finger drum.

In the metal range we use hand bells. For these I use tuned lengths of aluminum tube mounted at the central node. The tubes can get quite long but look good when arranged in sets of tuned lengths, and the tone is clear and strong.

Most recently, a totally new PVC pipe and drum station has been devised incorporating a bass drum on a stand as the support structure. This instrument features two tiers of 7 x



Photo by Stuart Sontier

40mm PVC pipes, which provide a pitch range one octave higher than the larger station. At each side of the drum a stand of roto-toms are mounted. At present we are using this instrument combined with one seven tube tier of the larger station. The bass drum/tube instrument nestles neatly

under the tier of large pipes. In total the instrument functions similarly to the original stations in that there are numerous sound sources available, but contrastingly, all of these can be played with the one style of beater -- the rubber bats. The bats are great for playing roto-toms as well as the pipes, bass drum skins, the wooden body of the bass drum, and the bats themselves used as clappers.

In addition to these instruments, I have been developing a set of hammered and bowed string instruments, but they are the subject for another discussion altogether.

For anyone interested to hear examples of the instruments described above, **From Scratch** has produced various records and tapes. For details write to Phil Dadson, From Scratch, PO Box 6298, Wellesley St., P O, Auckland, New Zealand. In addition, we have a book available called the **From Scratch Rhythm Workbook**, a hands-on manual of rhythm games and exercises, with appendices covering contextual background and instrument information as described here.

Phil Dadson thanks Bart Hopkin for fine tuning this article.

APPENDIX: INSTRUCTIONS FOR MAKING TUNED BAMBOOS

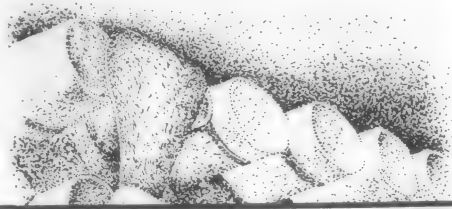
Tuned tongue bamboos can be made using bamboo tubes either closed at one end (by a natural node or some other stopper) or open at both. Either type will work, but a tube open at both ends must be about twice the length of a closed one to produce the same pitch. Because bamboo is of variable thickness and diameter, no two bamboos are exactly alike: two bamboos tuned to the same pitch may differ in overall length and tongue length.

The chief concern in making these instruments is to achieve acoustic coupling by bringing the enclosed air resonance in tune with the tongue tone. The tongue is created by cutting the two slots to form its sides. Gradually lengthening these slots amounts to lengthening the tongue, causing its pitch to drop. In the same process, the air resonance pitch rises, as the lengthening of the slots has the effect of opening the tube over part of its length. Thus, as the slots become longer, the two pitches approach one another. Eventually they come close enough that the vibrations begin to reinforce one another, and the desired acoustic coupling is achieved. The best coupling is when the pitches are just short of matching -- the air resonance tone slightly lower. (Thank you, Harry Partch, oh you know!)

But let us backtrack. Since our goal is to tune each bamboo to a certain pitch and not just accept whatever pitch happens to arise as the coupling pitch, we have to begin by selecting or cutting a piece of bamboo of the right size to land us in the right place in the end. That is, we need a length of bamboo that will produce an air resonance of the desired pitch after the tongue has been cut to the right length. This will be one with a natural resonance about a 4th or 5th below the desired pitch, since typically the air resonance frequency will rise by that much when the slits are cut. (The resonance pitch can be checked at any time by striking, or by edge-blowing, flute-like, over the slot or the open end.) For stopped tubes, acoustic coupling is usually achieved when the tongue is somewhere between 1/3 (for lower tones) and 1/2 (for higher tones) the overall length of the bamboo. With this in mind, we begin by cutting the slots on either side of the tongue just short of 1/3 of the tube length. We then check the pitch of the tongue against the pitch of the cavity by tapping the tongue and blowing across the base of the slot. Most likely, the tongue tone will be high and the air tone low. We begin lowering one and raising the other by further lengthening the slots, both sides evenly, cutting only 1-2 mm at a time as they approach coupling. At this critical point, the important thing is to get the air resonance right (that is, very slightly below the desired tongue pitch for best coupling). We have to be careful not to cut the slots too long and raise the air resonance too high. If this happens, it can't be undone (but save the bamboo -- you can shorten the whole piece and use it for the next higher pitch in the series.)

If we chose the bamboo well at the start, then when the air resonance is right, the tongue pitch will be close to the desired pitch. The tongue can then be fine tuned: lower it by rasping on top at the base of the tongue. Raise it by rasping the end very slightly underneath (thanks again, Harry). That done, the individual bamboo tongue drum is complete; the process can be repeated for the next drum at the next pitch, and the next after that, until the set is complete.

The mounting method we use involves fitting the bamboos -- low to high, left to right -- onto a crosspiece affixed to wooden base, with foam pads between the crosspiece and the bamboos. Each bamboo is fastened with a strip of rubber cut from a car inner tube. The rubber encircles the bamboo, passing through slots in the crosspiece at the sides of each tube, and is tied underneath.



ARTSPIRIT SINGS

by Lynn Slattery Hellmuth,
with additional notes by
Tiit Raid, Enrique Rueda and Mary Michie

In 1988 a museum in Wisconsin was sued by the parents of a visually impaired child who was brought to the museum on a field trip and found nothing to experience there. Lynn Slattery Hellmuth, author of the article that follows, was at that time working on a sound sculpture environment for the University of Wisconsin in Eau Claire. It occurred to her then that an exhibition of sound sculpture would make art accessible to the visually impaired. She took this thought to several other sound artists; the idea was well received, and the planning began for Artspirit Sings.

Artspirit Sings is a musical art exhibition currently touring the State of Wisconsin. The artworks are sound sculptures created by visual artists, some of whom are musicians. A highlight of the exhibition wherever it is shown is an improvisational concert performed solely on the sound sculptures.

The exhibition features a wide variety of artistic and musical expression. There are exquisitely crafted sculptural instruments by painter/woodworker/musician Enrique Rueda, Native-American-inspired wood and clay works by sculptor Truman Lowe and ceramist Katharine Goray Moore, various metal works by sculptors Peter Flanary, Eric Saunders-White, Mary Michie, Janet Shapero and Andrew McGovern, ethnic-inspired instruments created by painter-musician Tiit Raid, and a playful menagerie of sounding animal sculptures by ceramic sculptor Don Hunt and sculptor Lynn Slattery Hellmuth.

Because of the eclectic nature of the sound sculptures, a great deal of versatility is required of the musicians. Tiit Raid, Enrique Rueda and Paul Perrone perform a marvelous improvisational concert reflecting their various backgrounds in music, from jazz to Latino, from very serious to wonderfully whimsical. Audio tapes are available from Vern Williams, 2528 Riverview, Janesville, WI 53545.

Artspirit Sings has entertained at the School for the Visually Handicapped in Janesville, the Leigh Yawkey Woodson Museum in Wausau, the Gallery of Fine Art in West Bend, the Berstrom-Mahler Museum in Neenah, and will be at the University of Wisconsin-Madison Memorial Union gallery from late January to late February 1991. Very Special Arts Indiana and the Indiana Arts League are currently applying for grants to bring the exhibition to Indianapolis in 1991. If you would like to bring **Artspirit Sings** to your area, or if you'd like any further information about the works of art, contact: Lynn Slattery Hellmuth, 914 Castle Place, Madison, WI 53703.

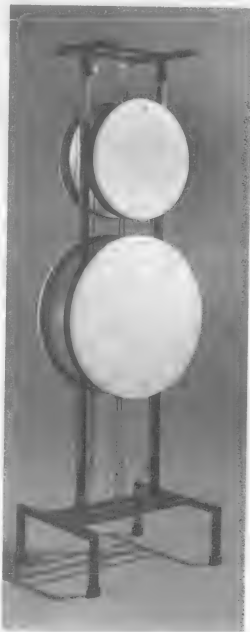
The descriptive notes accompanying the photographs were written by the artists.



Above: TIIT RAID **Pedal Berimbau** 1989

This sculpture/instrument is based on the Brazilian/African single stringed and single gourd instrument called the Berimbau. The Pedal Berimbau is played by striking the single wire with two thin wooden sticks. The gourds function as resonators and the shape and size of the gourds determine the quality of the sounds, as does the wire, which in this case is a #15 piano wire. Depressing the pedal which is attached to the bow lowers the pitch. Striking the wire at different points further alters the sound, and the gourds add another sound when hit or scraped with the sticks.

The instrument makes a low "wiry" drone when the wire is struck.

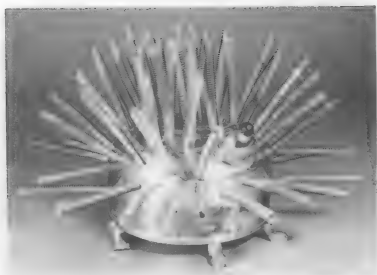


At Right:
TIIT RAID

Hand Drums 1989

These four suspended drums are played with the hands and fingers. They can be played by either one or two people, from the front or the sides. The best sound is produced by a sharp, gentle blow, using one, two, or more fingers. The upper two drums are each 16" in diameter. The lower two drums are 22" in diameter.

Although this sculpture is interesting as is, I have plans to add elements to it in the future, perhaps bells, small cymbals or other small drums. These would be attached to the upper and/or lower metal supports.



Above: LYNN SLATTERY HELLMUTH **Kettledrum**

This piece consists of a copper kettle with screwed-in copper springs and brass feet. It is played by running the hand over the springs. The sound can be changed by adding water to the kettle or by sloshing water around in it while the springs vibrate. It produces a not-too-subtle "drum roll" sound.



Above;
LYNN SLATTERY HELLMUTH
Hedgehog I

The Hedgehog I is made of walnut wood and piano wire. A subtle sound can be created by running one's hand over the piano wire front to back. The wires vibrate and strike one another gently.

Right:
LYNN SLATTERY
HELLMUTH
Zebraophone

This is a black and white wooden zebra with aluminum tubes on the sides. It is played by hitting it with yarn-covered strikers.



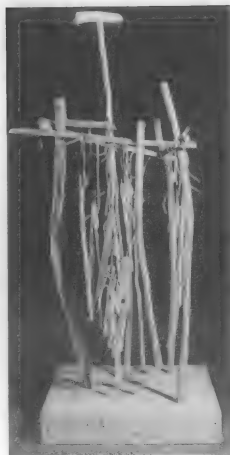
Below: LYNN SLATTERY HELLMUTH **Kopu, Sacred Singer**

The Kopu is an eight foot long cherrywood logdrum. It has several tongues of wood carved into the top, and a cap on one end. Sound is produced by striking these with a mallet or other object. The photo shows Paul Perrone improvising on various parts of the drum during a performance at West Bend Gallery of Fine Art in West Bend, Wisconsin.



Right:
TRUMAN LOWE
Willow Sound

This sculpture/instrument is constructed of willow sticks and hide strips. It is played by holding the top of the instrument and moving it around so that the wooden parts strike one another. As the hanging pieces strike one another a pleasing wood-on-wood sound emerges.

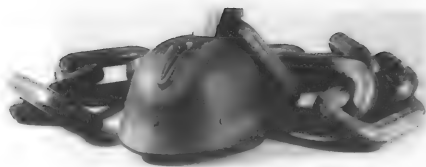




Left:
ENRIQUE RUEDA

Tambor de Agua (Water Drum)

This instrument is made out of two half calabashes. The body is designed as an allegory of a water animal like a whale, made out of Cuban mahogany. The principle behind this drum has been used by many cultures around the globe. The larger half calabash is attached to the body of the instrument and is filled with water. The smaller half calabash floats in the water with its dome upwards, creating a semisphere of air floating on top of the water. When the floating half is struck with a soft mallet it produces a beautiful deep resonant sound slightly similar to the orchestral timpani. I improved on the traditional design by suspending the small calabash with three rubber cords, which allows the player to tune the drum to a desired pitch within a one and a half octave. The floating half calabash can also be manipulated with one hand while striking it with the mallet using the other hand. This produces hollow-controlled sounds with a hint of African talking drums.



Above:
ENRIQUE RUEDA

Maroon's Vision of the Future

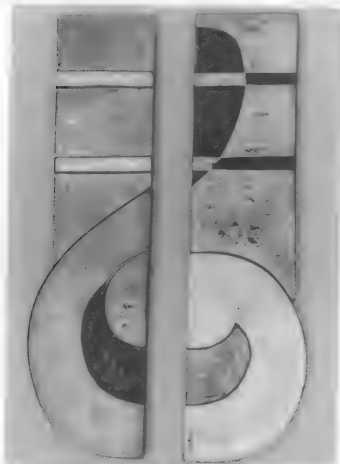
This instrument is an eight foot wooden chain attached to the top of a wooden military helmet. The helmet has at its base a ratchet which simulates the sound of a machine gun. The links that make up the chain are hollowed out and filled with seeds to produce shaker-like sounds. The chain and helmet are made out of African mahogany. The ratchet is Honduran rosewood and ebony with brass pins.

The instrument is played in a way that enhances the statement of the piece. The player carries the chain around her/his neck, letting it hang to the player's waist. The helmet is held with the left hand while the right produces the sound underneath it with the ratchet. The scary machine gun sound, and the chain around the human player's neck, visually transport us to Latin America where the "new" military slavery is in fashion.



Right: **ENRIQUE RUEDA Tambor con Patillas (Drum with Three Legs)**

This drum is a sort of hybrid between an Andean Bombo Leguero and a Caribbean Conga. It can be played with heavy mallets or with bare hands. The head of the drum is made out of the skin of a Camuro, which is a cross between a goat and a sheep. The membrane can be tightened by pulling the hide ropes as in the Bombo Leguero. The body is made out of redwood strips. The top is circular and the bottom is oval and open. The three legs that hold the drum's body are made out of Goncalo Alvez wood and ebony. The back leg, opposite the player, can be moved to change the inclination of the drum to suit the player. Its low sound reminds us of the American Indian drum.

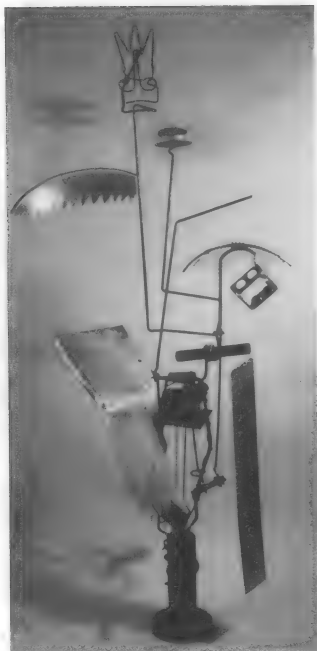


Left and above:

MARY MICHIE Gaia's Voice (sketch) and Door to the Music Room (photo)

Both **Gaia's Voice**, bronze, and **The Door to the Music Room**, aluminum, consist of flat sections of metal mounted on a wooden base. The metal sections are fastened to the wood with one inch squares of neoprene foam attached with velcro at the nodes. Because the metal pieces are quite thick – varying from 1/4" to 1/2" – they respond to striking with full, ringing tones.

I am indebted to Bart Hopkin for invaluable information when I began working on these Sound Sculptures.



Left:
ERIC
SAUNDERS-
WHITE
Modernicus
Modernicus is
constructed of
industrial rem-
nants and is
played by tap-
ping or stroking
with metal strik-
ers to create a
metallic, indus-
trial sound. The
hanging metal
piece at the
lower left can be
struck, or it can
be shaken to
create a twang-
ing sound.

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THE MATZAAR AND ALIQUOT TONE SCALES

By H. Barnard

Those who remember my article published in EMI Vol. III #1¹, or can easily find it, will need no introduction into the Kayenian Empire. For those for whom this is all too long ago, a brief explanation follows: the Kayenian Empire is an imaginary country of about 2 million sq. km. and 22 million inhabitants. During the 2500 years of its existence this empire has developed a rich culture of which music is an important part. To play this music the Kayenians use the tuning according to Shoureek: a just 19-tone system. One of the exceptions to this is the subject of this article.

Because nothing can be imported from an imaginary country, I had to build the instruments to play Kayenian music myself (or, via the Vvk-foundation², ask others to do this for me). Articles about these instruments have been

published in various magazines.^{1,3,4}

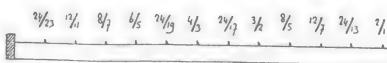
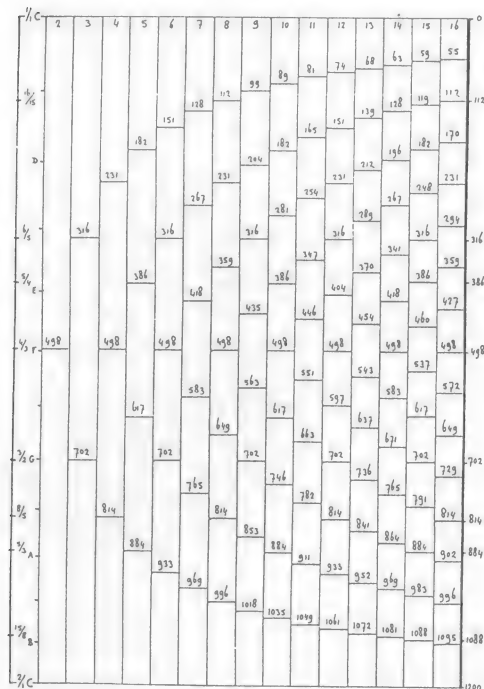
One day, a friend, called Matz, asked me to develop a special instrument for him -- an instrument he could play during the free-style jazz performances he used to give. While doing the dishes, I invented the matzaar: a kind of electric guitar with the frets at equal distances. After some calculations, I decided that a division of the octave into twelve equal parts (equal in distance, that is) would be the most suitable. This way, the fourths and fifths would be just. To assimilate the calculations and later the building of this instrument into the Kayenian Empire, I named the tuning of the matzaar after a famous Kayenian composer: Intooseel.

Years later, I read an article in an American magazine describing the tuning I invented⁵. The author, Michael Sloper, calls the tuning "aliquot" (after the Latin term for dividing into equal parts) and names arguments for the existence of aliquot tonescales both in historical and ethnological tuning systems. Besides the division of the octave in twelve equal parts (aliquot-12) he discusses the aliquot-13, the aliquot-24 and the aliquot-60 tuning.

Because my friend (and his matzaar) moved to Great Britain, and because there can be no electrical instruments in the Kayenian Empire, I decided to change one of my

LEFT:
Aliquot tone scales 2 through 16, with values expressed in cents. The graphic scaling corresponds to fretboard spacing (thus, the chart is not scaled for uniform interval sizes). For comparison, basic just intervals and 12-equal appear on the left.

RIGHT: The MATZAAR, with its Aliquot 12 fret spacing shown below.



guitars into a matzaar. I removed the frets, filled the slots with plastic wood and smoothed the finger-board with sandpaper. Then I made new slots at the new locations, varnished the finger-board and glued new frets in place. After a second varnishing, I put up a new set of strings and tuned them fourths apart. This method is quick and effective and can be recommended to anybody experimenting with tunings. After the matzaar, I rebuilt another guitar to play a modified version of the just 19-tone Shoureektuning^{6,7}.

In the table that follows, the intervals for aliquot-2 through aliquot-16 can be found, expressed in cents (hundredths of a semitone). On the left the tones of the C-major scale are given, and alongside them are basic just intervals expressed as ratios. The same intervals can be found on the extreme right, written in cents.

If you have any questions or remarks about the Kayenian Empire, or the Kayenian music, do not hesitate to contact me:

H. Barnard
Admiraal de Ruyterweg 85
1056 ET Amsterdam
The Netherlands

REFERENCES:

- 1 H. Barnard, W.Z. Wendrich and B. Hopkin; "Kayenian Musical Instruments." **Experimental Musical Instruments** III, 1 (June 1987); p. 14-15.
- 2 "Vvk" stands for "Friends of Kayolonia." The Vvk-foundation was put up in 1981 to protect the Kayenian Empire artistically and financially.
- 3 H. Barnard and D.J. Hamoen; "Het 19-toons orgel uit Keiolonia." **Bouwbrief** 34 (August 1984); p. 14-19.
- 4 H. Barnard, L. Sluiter and B. den Hollander; "Keiaanse muziekinstrumenten." **Bouwbrief** 37 (May 1985); p. 7-8.
- 5 M. Sloper; "Aliquot Scales." 1/1 (The Quarterly Journal of the Just Intonation Network) VI, 1 (Winter 1988); p. 2 and 14.
- 6 H. Barnard et al.; **An Introduction to Kayenian Music**. Amsterdam- Texel 1986 (second edition).
- 7 **Archives of the Vvk-foundation; A Selection of Ten Kayenian Instruments**. Amsterdam- Texel 1987.



CASSETTES

Notes by Bart Hopkin

Here are more reviews of independently-produced cassettes featuring unusual musical instruments. The reviews are designed to be informative rather than critical; we've simply tried to indicate what is on the tapes and where to get them. Following the short reviews on this page we have a more extended review of an important compilation tape, newly released by Stamp Axe.

JON ROSE:
FEATURISMS / THE RELATIVE VIOLIN
Fringe Benefit Records, 172 Riverview Ave., Dangar Island, New South Wales.

"The Relative Violin" is the name Jon Rose has given to a set of performance parameters he has developed around the violin. They involve extensive physical alterations of the instrument, as well unconventional playing techniques. Rose's violins are pulled apart and reassembled; various small sounding objects are attached to them; they are strung every which way; very tall and very short bridges are used; odd things are used for bowing; percussive techniques are exploited as well; electronics are added; and the music is often recorded in bizarre circumstances. This tape is one of several documenting the development of The Relative Violin and Rose's improvised performances. Most of the sounds heard here have an edgy, scrappy quality.

DARRELL JONSSON:
URBAN SPACE EPICS
Gardener Productions, 115 S. Topanga #154, Topanga, CA 90290.

The predominant instruments here are Jonsson's kalimbas, nicely recorded to capture the piquant irregularities of their sound. Over the kalimbas he incants a peculiar half-sung poetry, mostly contemporary in subject matter and vocabulary, but with an archaic feel. One track adds guitar, bass and keyboards.

WILLIAM EATON: **TRACKS WE LEAVE**
Canyon Records Productions, 4143 North 16th St., Phoenix, AZ 85016.

William Eaton is the maker of the beautiful guitar and harp-like instruments that appeared in EMI's April 1989 issue (Vol. IV #6). On this cassette he plays several of them, in pieces with many rapid notes running together to create flowing

textures. He is joined by R. Carlos Nakai playing Native American flutes, Rich Rodgers playing shakuhachi & percussion, Claudia Tulip on orchestral flute, Arvel Bird on violin, and Udi Arouh on tablas and guitar. Plucked strings and flutes dominate most of the pieces. William Eaton and R. Carlos Nakai also recently collaborated on **Carry the Gift**, also released on Canyon Records.

SARAH HOPKINS AND FRIENDS:
HEARTSONG
Resource Recordings, GPO Box 4168, Darwin, N.T. 0801, Australia.

Sarah Hopkins wrote about whirlies in EMI's October 1989 issue (Vol. V #3). Whirlies are flexible corrugated tubes, usually about four centimeters in diameter and a meter or more long. The rush of air through them produces the tones of a harmonic overtone series when the tubes are whirled overhead. In this recording we hear a chorus of whirlies -- an extraordinary sound -- joined in parts by handbells, singing bowls, wind chimes, spirit catcher (an outer-air chordingophone made by Darrell De Vore), harmonium, and voices, including some harmonics singing. Sarah Hopkins has also recently produced the CD **Sky Song** with Alan Lamb, on the Polygram label.

CATHERINE FAVRE: **PLANET HARP**
Studio Luna, Box 252, Half Moon Bay, CA 94019.

Side 1 of this tape features the pentatonic Magical Moon Harp, designed, made and played by Catherine Favre after a 14th century Finnish instrument. Side 2 features several pieces played on Ngombi, a harp from Gabon, played here by Catherine Favre, E. Roma, Paul Giacomantonio, and Joseph Mange Isingua. Some percussion, whistles, synthesizers and ambient natural sounds appear as well. Lovely plucked string sounds in simple, translucent music.

NADI QAMAR: **NIGHT MUSIC**
Nuru Taa Arts, Rt 1, Box 274, Kewaunee, WI 54216.

Nadi Qamar makes and plays several varieties of Mbira, plus some African string instruments and occasionally fingergongs. Several of his mbiras extend the sound producing elements of the instrument to include very long, curved, gong-like rods, special resonators, and other features. The mbiras feature

prominently on this tape, in rhythmically and texturally diverse, richly decorated melodic phrases. The gongs, membranophones and other percussion, as well as plucked strings and some voice and mouth sounds, can be heard also.

DAN SENN: **SCRAPERCUSSION IMPROVISATIONS**

Newsense Records, 1020 Warwick Rd., Muncie IN 47304

Dan Senn's Scrapperdiscussion sound sculptures are complex structures of welded metal. Senn plays different parts of the sculpture by percussion for a variety of timbres. In addition, he creates electro/acoustic feedback loops that pass through the sculpture as one link in the feedback chain, in manner roughly analogous to the function of the string in electric guitar feedback. The resulting sounds, heard on this tape, have much of the wild, screechy, wailing quality associated with microphone feedback, but here they are clearly held under the performer's control; they also are generally more complex in timbre.

TOBIAS KAYE AND ROBERT SQUIRES: **BOWL MUSIC**

MagpieMusic/Whites Cross, Buckfastleigh, Devon, England TQ11 0LS

Tobias Kaye makes exquisitely turned wooden bowls. To these he attaches sets of several strings across the open top. The bowls are heard here, accompanied at times by guitar, swan zither and wood. There is something about these simple pieces, with the tone of the bowls and their ear-instantive tunings, that is inexplicably attractive.

VARIOUS MECHANICAL INSTRUMENTS: **MUSICAL MUSEUM MEMORIES VOLUME I**

The Musical Museum, Route 12-B, Deansboro NY 13328

This tape features recordings of late 19th and early 20th century mechanical instruments now residing and the Musical Museum in Deansboro, NY, and maintained by museum curator Art Sander. Included are several orchestrions (the term usually used for mechanisms playing many different instrument types simultaneously like an automatic band), a violano virtuoso, Nickelodeons and Wurlitzers of various sorts.

UDU DRUM: **ORIGINAL MUSIC COMPOSED AND PERFORMED BY MINO CINELU & GEORGE JINDA**

UDU Drum, County Rt 67, Box 126, Freehold, NY 12431

This tape was produced by Frank Giorgini, maker of UDU Drums, as a vehicle for his instruments. The performers are leading percussionists in the Latin, jazz and fusion fields (credits include Miles Davis, Weather Report, Sting, Special EFX and others). The UDU Drums are ceramic side hole pot drums whose tone is a mixture of the idiophonic percussion of the clay body and the deep, rich, lithe and variable air resonance tone. One section of the tape is a demonstration of several drum types, and includes narration; the rest contains pieces for UDU Drums alone and in combination with other percussion and a little synth. One piece from this tape appeared on EMI's volume V tape.

HANK TILBURY: **DEFECTIVE RECORDING**

Hank Tilbury, Recording Services, Interlochen Center for Arts, Box 199, Interlochen, MI 49643-0199

The opening composition here, "Three Pieces for Kitchenware," features pots and pans and mixing bowls and such used effectively and imaginatively. Following that are

lots of electric guitars prepared, processed and played in diverse unconventional ways (including electric guitar as aeolian harp), as well as kalimbas, found radio sounds and some natural sounds.

DENNY GENOVESE: **STARLIT JOURNEY**

Denny's Sound & Light, PO Box 993, Nokomis, FL 34274

A variety of acoustic and electronic instruments are featured here, most of which were created by the artist himself. These include fipple pipes, tubular bells, refretted guitar, hammer-strings, small harp, various drums and percussion, electronic organ and digital synthesizer. All of the music is in just intonation, composed and performed by Denny Genovese. Ensemble effects are achieved through multi-track tape technique. There is a wide spectrum of moods and textures, with many odd rhythms and exotic intervals.

DAVID AUERBACH: **CAROLS IN THE CAVES**

Improvisator Music, 1440 Spring St., St. Helena CA 94574

David Auerbach gives Christmas concerts each year inside caves in California's wine country, playing his large collection of instruments from around the world. Included in this collection, enhanced by the reverberant environment of the caves, are carols both new and familiar played on bowed psaltery, santur, kora, steel drums, pan flutes, various harps and dulcimers, bells and chimes, vox humana, and many more instruments.

VARIOUS ARTISTS: **STAMP AXE VOL. 6 #1, "Instrumains / Handstrumment"**

Stamp Axe, A/S Pier, Poste 109 Station C, Montreal, Quebec, H2L 4J9, Canada.

Recorded compilations devoted to sound instrument explorations by various builders and artists are relatively rare; yet here happily we have the second such collection to appear in recent months.

Stamp Axe is a limited edition periodical series, edited by Pier Lefebvre in Montreal. Different issues in the series take different forms, depending upon what media seem suitable for the topic at hand. Vol. I #1, for instance, was a photocopied compilation of work by various graphic artists, plus an envelope containing other items modified with stamps, stickers, hand drawings and such, all wrapped in acetate sewed at the edge. Other issues have included silk screens, cassettes, cut outs, and pieces of plastic, burlap, herbs and earth. The new "Instrumains / Handstrumment" collection consists of two cassette tapes, a booklet of seventy-two photocopied pages, and some loose papers and cards, packaged in a binder-like double cassette carrying case.

The collection features excerpts from the work of about thirty sound artists from Europe and North America (see the complete list at the end of this review). Some work with playable musical instruments; some with electronics; some with sound sculpture; some with recorded found sound or sound collage -- quite a diverse sampling all told, with musical material amply balanced by noise play.

In the booklet are apparently unaltered reproductions of original written materials submitted to the editor by each of the individual artists. They vary wildly in style and approach: some are careful documentations of instrument construction, with drawings, photos and text; some are cryptic graphics and little more. Some are in French, some in

English; some are short, some long; some are informative, relevant and to the point, while some are deliberately obscure. Wading through them is sometimes a delight, and sometimes a drag.

As often happens with cassette tapes, in this collection it is difficult for the listener to figure out where he or she is in the cassette at any given time -- as in "OK, I know I'm about halfway through side A, but is this track 3, 4 or 5 I'm hearing?". This makes it hard to connect the information in the booklet with the sounds on the tape. But with a little effort, I think that I have finally found my way around well enough to comment on some of the pieces:

The tape opens with Lief Brush's Terrain Instruments, which are environmental sensors in the form of wires, metal plates and the like equipped with contact mics, strung up in natural areas where they will be agitated by wind, struck by raindrops, and buzzed by insects. The sounds are quite pretty, and the random patterns of rain and wind make a good meditation.

From Triptic of a Pastel Fern we get "I'm Not At Home Now," a piece using a Phone Tone Synthesizer built by Arthur Harrison. The Phone Tone Synthesizer manipulates three basic phone signals (ring, dial tone and busy signal). The piece also includes recorded telephone voices and some other instruments.

Pier Lefebvre's Cornbines are bagpipe-like instruments (but with air from a compressor?). They are joined here by a couple of other wind pipe instruments to create an appealing, droney piece called "Cornbines et Pip-Oil."

In the early seventies, Godfried-Willem Raes of Stich-tung Logos in Belgium created a miniature synthesizer using chips designed for gambling machines and video arcade games. "For Synthe-log & Piano," the piece heard here, is unfortunately dominated by the latter instrument, but the synth can be heard behind it, producing a variety of electronic sounds.

"Mind of Red Eyes," by Black Flowers, uses what appears to be an electric zither with some sort of mechanized sliding system. The piece is heavily processed electronically, but its overlapping sliding tones are effective.

Toyo, whose work is scheduled to appear in a coming issue of EMI, uses (among other things) bagpipe-like drone instruments set off against metal tube marimbas.

Readers may recall photographs of two gourd instruments made by Liz Was and Miekal And in the letters section of last June's issue of EMI (Vol. VI #1). They can be heard here in "Chanson d'Exhumation," by Floating Concrete Octopus. Divine Monogourd is a string instrument; Marankan Gourdophone a single reed; they are joined here by a gourd kalimba and a gourd rainstick, plus a sampler.

"Homemade A.B.C." features a group or person called Agog playing a seemingly simple and crude stick-with-string attached to a large square soy sauce can resonator. It turns out that Agog is able to coax a remarkable variety of sounds from this arrangement, not only plucking and bowing the string, but bowing and scraping the can itself as well.

The prevailing editorial attitude behind the *Stamp Axe* compilation seems to be to allow whatever speaks to speak how it will, with wildly contrasting aesthetics abutting one another unmitigated, and esoteric material often presented

with minimal explanation. The result is sometimes confusing. Let me encourage anyone who gets this tape to try to follow the booklet along with the tape in order to know just what it is that they are hearing in each segment. The sounds then become more meaningful; the personalities of the artists -- somewhat riotous and disorienting in this willfully undisciplined presentation -- more enjoyable. There are a few beautiful pieces here, and several more interesting, enjoyable or enlightening ones, and as is usually the case with sound art tapes like this, most of it is material will find nowhere else.

Artists appearing on *Stamp Axe* Vol. 6 #1 but not mentioned above include: Itoh Tadayuki, Luigi Bob Drake, Nicola Frangione, Andrzej Dudek Dürer, Patrice Labastro, Crown, Systeme Septiques, Coction Itou, Valium et les Dépressifs, Kid Contrast, Hoagart, Kristian Lehmann, Richard Graham, Normand Lacroix, Sylvie Royer, Steve Godin, Raga Saga, Chaotic Joeri, Odds, Le Paradis, Red Däkin, Murray Reams, John Boyle, Ry Nikonova.

A NINE STRING GUITAR

John Jordan made this steel string guitar in 1987. The deep cutaway allows for 29 frets, and the half round sound hole was chosen to accommodate the long fingerboard. Intended tuning is B E A D G b b e c.



STRINGED INSTRUMENTS OF ANCIENT GREECE.

By Martha Maas and Jane McIntosh Snyder

Published in 1989 by Yale University Press (New Haven and London): xx + 261 pp.; biblio, index, illus.

Plus excerpts from

INTRODUCTION TO PHYSICAL SCIENCE,

By A.P. Gage

Published in 1898 by Boston: Ginn & Co. ("Reading Nature in the Language of Experiment" Series)

Reviewed and excerpted by Charles Adams.

In EMI's last issue (Vol. VI #3, Oct. 1990), reviewer Charles Adams looked at books on ancient musical science. He returns now with two addenda: A brief report on a recently-released book on ancient Greek instruments, and selected sections from a turn of the century high school physics text, describing simple acoustical experimental apparatus for initiate musical scientists of a latter day.

STRINGED INSTRUMENTS OF ANCIENT GREECE.

This is a comprehensive, scholarly and detailed survey of ancient Greek harps (trigonon), lyres (lyra, phorminx, kithara, barbitos) and lutes (pandoura, skindapsos). It covers the period from Homer and Hesiod (c. 525 B.C.) to the deaths of Alexander the Great and his tutor Aristotle (323 B.C.). The text is based on an integrated analysis of some 700 literary references (from epic and lyric poetry, drama, inscriptions and philosophy) and some 2000 visual representations (from vase and wall paintings, sculptures, archaeological materials). Included are 140 black and white photographic illustrations. Maas and Snyder discuss continuities, innovations and variations in materials, performance contexts and techniques, tunings, etc. Refreshingly, the authors adhere closely to the primary extant evidence, avoiding the later historical speculations and re-interpretations.

Below and right: Vase paintings reproduced in **String Instruments of Ancient Greece**. Lyres and aulos.



ILLUSTRATIONS OF THREE "EXPERIMENTAL INSTRUMENTS" FOR SOUND AND MUSIC: DIAPASON, VIBROGRAPH, SONOMETER

(from **Introduction to Physical Science**, by A.P. Gage (Ph.D., Instructor in Physics, English High School, Boston).)

Here are three sound instruments of a sort not usually seen in these pages: devices for acoustical experimentation, taken from this early high school text.

Graphical Method of Studying Vibrations

Experiment 159 -- Attach, by means of sealing-wax, a bristle or a fine wire to the end of one of the prongs of a large steel fork (like a tuning fork, but larger) called a **diapason**. Set the fork in vibration, and quickly draw the point of the bristle lightly over a smoked glass (A, Figure 218). A beautiful wavy line will be traced on the glass, each wave corresponding to a vibration of the prong when vibrating as a whole.



Fig. 218.



Method of Representing Sound Vibrations Graphically

Figure 233 represents wave lines drawn by an instrument called a **vibrograph** (figure 234). The second line represents a sound two octaves above that which the first line represents, and the third line shows the result of the combination of the two sets of vibrations.

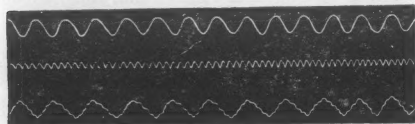


Fig. 233.

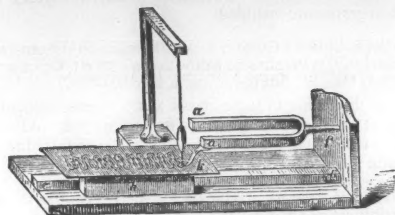


Fig. 234.

Sonometer

Experiment 179 -- Stretch an elastic wire *a* over the bridges of the **sonometer** (Figure 228), so that the portion between will be free to vibrate ...

... Next, place a movable bridge *d* half-way between the two fixed bridges ...

... Stretch another wire *b* ...

... Increase the tension of either wire by turning the pin, to which one end of the wire is attached, with a wrench c...



Fig. 228.

NOTICES

QUARTZ CRYSTAL "SINGING" BOWLS -- perfect musical instrument -- each bowl plays a different musical note -- especially helpful for music therapy -- the bowls make people smile -- they are perfect stress eliminators -- 12 sizes -- frosted & clear -- chakra-tuned -- all credit cards accepted -- The Crystal Store -- 1-800-833-2328.

WHERE SAWS SING AND FIDDLES BLOOM: A 60 minute cassette of duet improvisations by Hal Rammel and Johannes Bermark on musical saws, waterphone, melodic, and various instruments designed and constructed by Hal Rammel. Write: Cloud Eight Audio, 1622 W. Sherwin, Suite 2S, Chicago, IL 60626.

DIDJERIDU -- Play this aboriginal wind instrument yourself. Find out why composers & players of avant garde and experimental music are re-discovering the oldest wind instrument in the world. Instructional cassette included. \$85.00. For information call or write Fred Tietjen, 26 Allen, San Francisco, CA 94109; (415) 474-6979.

THE ONLY BOOK IN SAWING: Scratch My Back: A Pictorial History of the Musical Saw and How to Play It, by Jim Leonard and Janet Graebner. Features profiles of sawyers world-wide in 124 pages of fascinating information. Includes over 100 photos and illustrations, index and bibliography. U.S. Dollars \$19.95, \$3 shipping/handling (in CA add 6% tax). For information, contact Janet E. Graebner, Kaleidoscope Press, 28400 Pinto Dr., Conifer, CO 80433.

THE FIRST ANNUAL CHICAGO INVENTED INSTRUMENTS FESTIVAL: Instrument building workshops, film & video presentations, and concerts, presented through December 8 at Club Lower Links, 954 West Newport in Chicago. For information contact Spencer Sundell, (312) 248-9496.

JUST INTONATION CALCULATOR by Robert Rich and Carter Sholz. A composer's tool for just intonation. Internal sound for tuning reference; microtonal ear training; shows modulations; reduces fractions; converts between ratios, cents, and Yamaha tuning units; MIDI tuning dumps for many brands of synthesizers. Requires Macintosh with Hypercard -- only \$10.00. Soundscape Productions, Box 8891, Stanford, CA 94309.

EMI BACK ISSUES: Back issues of **Experimental Musical Instruments** numbered Volume VI #1 and later are individually available for \$3.50 apiece. Earlier issues are available in volume sets of 6 issues each, photocopied and spiral bound: Volumes I through V, \$14 per volume. Order from EMI, PO Box 784, Nicasio, CA 94946, or write for complete listing. Corresponding cassette tapes also available for each volume; see information below.

CASSETTE TAPES FROM EMI: From the Pages of Experimental Musical Instruments, Volumes I through V, are available from EMI at \$6 per volume for subscribers; \$8.50 for non-subscribers (each volume is one cassette). Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Order from EMI, Box 784, Nicasio, CA 94946.

A REMINDER -- Unclassified ads here in EMI's notices column are free to subscribers for up to 40 words; 30 cents per word thereafter. For others they are 30 cents per word, 15 word minimum, with a 20% discount on orders of four or more insertions of the same ad.

MICROTUNAL MIDI TERMINAL (vers. 1.2) by Denny Genovese lets you play nearly any MIDI synthesizer in Just Intonation! A veritable "tuning processor" as well, it has many features for constructing, editing, transposing, analyzing and printing Just Scales. Tuning data is shown in Ratios, Cents, Frequencies and Yamaha TU's. Those without a MIDI instrument can hear the Just scales on the computer's built in speaker. Holds 16 scales in memory, which are selected by single keystrokes. Tunings may be transposed into any key with another quick stroke. Requires IBM XT/AT or compatible and, for performance, an MPU-401 or compatible MIDI interface. \$60 from DENNY'S SOUND & LIGHT PO Box 12231 Sarasota, FL 34278.

WIND, STRING, PERCUSSION DEMO/TECHNIQUE CASSETTE -- 60 min.. Waterphones on side A, many other instruments & sound devices on side B. Send \$8 + \$2 (pack. & ship. -- \$3 for overseas). \$8 is deductible from purchase. Richard Waters, 1462 Darby Rd., Sebastopol, CA 95472, USA.

"PROSE IN CANNES" is a radio show on Macalester College's FM station WMCN. The show will expressly exhibit and entertain experimentation. All contributions of either primary or secondary nature are welcome (cassette, 1/2" or 1/4" loops, etc.). Write in care of: Roger Skulback, 1600 Grand Ave., St. Paul, MN 55105.

Frog Peak Music announces version 4.0 of the HIERARCHICAL MUSIC SPECIFICATION LANGUAGE. HMSL is an interactive programming language for experimental music. It gives the user numerous tools for exploring algorithmic composition and real time interactive performance. Versions available for Macintosh and Amiga.. A cassette featuring 12 HMSL composers is available for \$8. Further information from Frog Peak Music, PO Box 151051, San Rafael, CA 94915.

PLANET HARP is a newly released cassette of original harp music from Ngombi, a traditional harp from Gabon, and the Moon Harp, designed by Catherine Favre, inspired by the Finnish Kantele. Available through Studio Luna, PO Box 252, Half Moon Bay, CA 94019. \$10 plus \$1 shipping; make checks to Catherine Favre.



The following is a selected list of articles of potential interest to EMI readers which have appeared in other publications recently.

"The Carved Harp: A pictorial Essay by Three Contemporary Craftsmen", assembled by Adam Victor Christensen, in **Folk Harp Journal** #70, Fall 1990 (4718 Maychelle Dr., Anaheim CA 92807-3040).

Harpmakers John Yule, Ronald Wall and Glenn J. Hill talk about their work. A total of 20 photographs highlight decorative carvings on the harps, beautifully done.

"Sound Bytes, Neon Dreams: The World of Music is Transformed by Instruments that Aren't like Anything Seen in Concert Halls", by Michael Rodgers, in **Newsweek**, Nov. 5, 1990.

An overview of recent developments in electronic instruments emphasizing, thankfully, not keyboard synthesizers but the wide variety of physical approaches to electronic sound control.

Lark in the Morning Musical Catalog, from Lark in the Morning, PO Box 1176, Mendocino CA 95460.

This is an annual mail order sales catalog, which happens to make good reading as well. Lark in the Morning specializes in sales of unusual and hard-to-find musical instruments. Herein can be found hardanger fiddles, hurdy gurdies, bag pipes, harp guitars, charangos, kokritos, angklung sets, steel drums, pipas, bamboo saxes, racketts, alphorns, musical saws, etc., etc., etc.

"The Polynesian Nose Flute" by Richard M. Moyle, in **Music of the World** Vol. XXXII #1, 1990 (Florian Noetzel Verlag, Heinrichshafen Books, PO Box 580, D-2940 Wilhelmshaven, Germany)

Information on the history, construction, scales and musical culture of nose flutes (flutes played by breath from the nostrils) of Samoa, Fiji, Tonga and other Polynesian islands.

WOOD, METAL & MECHANICAL CONNECTIONS, an interview with Gabriel Kney, by Roger Burford Mason, in **Musicworks** 47 Summer 1990 (1087 Queen St. West, Toronto, Ontario, Canada M6J 1H3).

Gabriel Kney is an organ builder. He discusses the process of working with a community to design an appropriate organ, and aspects of the building and tuning process.

"Sound Vision" by Heather Doran Barbieri, in **High Performance** #51, Fall 1990 (1641 18th St., Santa Monica, CA 90404).

A review of **Sound Vision**, last spring's sound sculpture exhibit at The Center on Contemporary Arts in Seattle. Exhibiting artists included Patrick Zentz, Paul DeMarinis, Alan Lande, Dennis Evans and Susie Kozawa.

"Why Top Guitar Makers Demand Schaller" (no author credited), in **The Music Trades** Vol. 138 #9, October 1990 (PO Box 432, Englewood, NJ 07631).

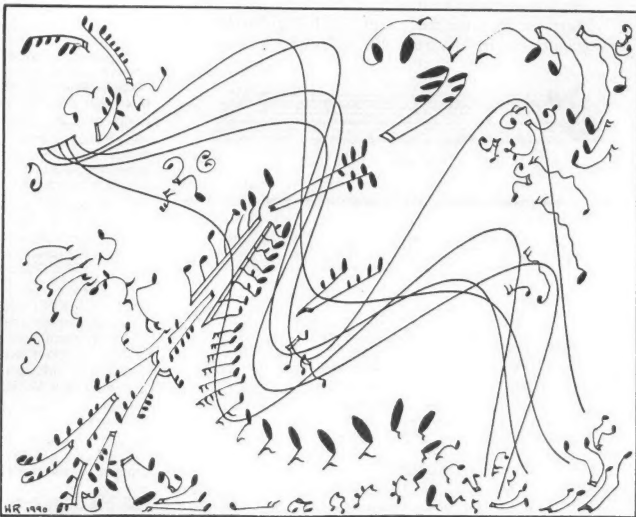
A report on the manufacturing operations of the Schaller company, German maker of high quality tuning machines for fretted instruments. Several informative factory floor photographs are included.

"A Buyer's/Seller's Guide to Antique Percussion Instruments" by Brian Stolz, in **Percussive Notes** Volume 29 #1, October 1990 (123 W Main St., Box 697, Urbana, IL 61801-0697).

A discussion of some classic snare drums, timpani and mallet percussion instruments fifty or more years old -- what gives them their special quality; how to recognize the ones worth salvaging.

"The Indigenous Use of Rasps and Ratchets and Its Influence Upon Western Art Music" by Norman Weinberg, also in **Percussive Notes** Volume 29 #1, October 1990 (address above).

The early history (and pre-history) of various sorts of rasps and ratchets is discussed here, with an emphasis on ritual and mythic associations. The author goes on to observe that such associations are diminishing in contemporary western music, as rasps are increasingly valued for their sound alone.



Graphic by Hal Rammel, (from a promotional flyer for a musical saw concert.)